State of Utah
Michael O. Leavitt, Governor
DEPARTMENT OF COMMUNITY AND ECONOMIC DEVELOPMENT
DIVISION OF BUSINESS AND ECONOMIC DEVELOPMENT
David B. Winder, Executive Director
Richard J. Mayfield, Division Director

October 1998

TO: RECIPIENTS OF THE 1997-98 UTAH CENTERS OF EXCELLENCE PROGRAM ANNUAL REPORT

Attached is the Annual Report for the Utah Centers of Excellence Program. The report summarizes the achievements of the program during the **fiscal year from July 1, 1997 through June 30, 1998** and in addition summarizes the funding allocations for the current 1998-99 fiscal year. The report has been formatted to provide special emphasis on Center's related business activity and program enhancements.

REPORT FORMAT

Since the founding of the Centers of Excellence Program in 1986, the Annual Report has summarized the financial and business accomplishments in terms of dollars granted, matching funds received, jobs created in both Centers and businesses, and other statistical data. This information provides appropriate measures of the status of the program, and is contained in this report in Appendices A and B. Every effort has been made to assure the accuracy of the statistical data, though it should be recognized that significant subjectivity is inherent in the summary of the numbers and in their interpretation. We have attempted to minimize the subjective interpretation of these statistics by supplementing them with anecdotal information which describes specific business activity related to the Center's Program, to provide more meaningful information relating to the overall impact which the program is having on Utah's economic vitality.

CENTERS RELATED BUSINESS ACTIVITY

In addition to the statistical summaries, the report includes descriptions of new Utah companies. The companies share a common heritage in that each bases its revenue stream on technologies developed at funded Centers of Excellence and have licensed those technologies from Utah universities. Our intent is to review the Centers of Excellence Program from the standpoint of its influence upon a group of Utah's newest high tech companies. We hope to demonstrate that the funding of the program represents an incredibly valuable investment in Utah's current economic base and in the ongoing development of her high technology industries. In addition to new companies, we have also summarized key license agreements signed and new patents issued as a result of Centers related activities.

PROGRAM ENHANCEMENTS

In this report we have also highlighted the most current efforts being made to further enhance the effectiveness of the program. Four years ago the Centers Program instituted a commercialization consulting program designed to inject professional business research and management techniques into the process of launching new technologies into the business arena. It had been observed in previous years that many center directors did not have the time or often the expertise to initiate successful commercial ventures. The expectation of this initiative has been that by managing the process in a more professional way, the Centers Program would have opportunity to significantly enhance its impact on economic development. The consulting initiative is now beginning to mature and there have already been noteworthy accomplishments both in actual economic impact and in our understanding of the dynamics of the Centers Program.

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During the fiscal year reported, the Centers Program issued $1.9 million in grants to 17 active Centers for use in bringing significant new technologies closer to the marketplace. The matching funds received by these Centers was $20.1 million, resulting in a matching fund ratio of 10.6 to one. The cumulative state funding for the COEP between 1986 and 1998 was $28.7 million and the cumulative matching funds received was $321 million, resulting in a matching fund ratio of 11.2 to one. This is believed to be the highest in the nation for programs of this kind and represents a critically important leverage for success in the program. Key statistical summaries are provided in Appendices A and B of this report.

The Centers of Excellence Program continues to be one of the nation's most successful technology commercialization programs as measured by matching dollars, significant new commercialized products, and state economic impact. We believe that with a continued and strengthened emphasis on the importance of commercialization and with the ongoing support of the new enhancements described, the Centers of Excellence Program will have an ever expanding and important role to play in Utah's economic future.

Respectfully submitted,

David B. Winder

David B. Winder, Executive Director
Department of Community and Economic Development

Richard Mayfield

Richard J. Mayfield, Director
Division of Business and Economic Development

Roderick J. Linton

Roderick J. Linton, Director
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UTAH
CENTERS OF EXCELLENCE PROGRAM

Annual Report

July 1, 1997 - June 30, 1998

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I. Executive Summary

EXECUTIVE SUMMARY

BACKGROUND OF PROGRAM

The Utah State Legislature created the Centers of Excellence Program(COEP) in 1986 recognizing that the growth of new industry and expansion of existing industry requires a strong technology base, new ideas, concepts, innovations, and prototypes. The Legislature recommended the allocation of economic development funds each year to the COEP, to be awarded to college and university faculty on a competitive basis. The objectives of the COEP are to enhance and expand the applied technical research activities at institutions of higher education in Utah, to develop technologies that are considered to have potential for economic development in the state, and to assist in the actual commercialization of those technologies. This research and technology commercialization process ultimately results in the creation of new companies, the enhancement of business opportunities for existing companies that license COEP technologies, and in the growth of Utah's job opportunities. In addition, the proprietary value of technologies created is reflected in the number of patents issued and the associated royalty-bearing licenses which are signed.

These measurement parameters (jobs created, companies assisted and/or created, patents disclosed or issued, and license agreements signed) are summarized in the report to the legislature as indicators of the value of the COEP to state economic development. The report will also highlight some of the specific businesses which have either been spun-off from funded Centers or been materially influenced by Centers of Excellence funding.

Ongoing funding of the program has been based upon the real and potential economic impact which the Centers of Excellence Program has had upon the State of Utah during the years since its creation. This Annual Report summarizes the significant accomplishments of the program during the recently completed fiscal year and attempts to identify the long term economic value of that work.

PROGRAM OPERATIONS AND OBJECTIVES

The operating methods of the Centers Program have evolved over the years since its inception with a continuing goal of achieving the maximum economic benefit from the individual Centers that have been created. Upon selection on a competitive basis, new Centers are funded with a requirement for minimum 2:1 matching fund ratio from the private and federal sectors. Matching funds are reported and audited on a regular basis. Centers are also audited regularly for the achievement of technical and commercial milestones. Center directors are required to submit annual reports to the COEP director. The Centers of Excellence Program Annual Report, here attached, is based on submitted reports and upon information gathered in site visits, audits and other data sources. In addition, each funded Center is assisted by one or more designated commercialization consultants who assist Center directors in defining commercialization strategies, performing market and competitive analysis, locating potential investors, etc.

Centers are normally expected to be self-sustaining through license contract royalties and new research grants at the end of five years and are then graduated. Centers with especially noteworthy histories and ongoing technological impact are designated as Distinguished Centers and thereafter may be funded on a project by project basis as requests are approved.

CENTER SELECTION PROCESS

Proposals from researchers for new and for renewal of existing Centers of Excellence are submitted to the COEP office in response to a Request for Proposal which is normally sent in late December. The incoming proposals are submitted to the National Institute of Standards and Technology for scientific peer review and are thoroughly reviewed by the Centers of Excellence Advisory Council. Centers are selected for funding based on a ranking established in extended review sessions with the Centers Advisory Council.

Since its inception, and through FY 1997-98, the program has created 70 Centers of Excellence, seven of which have been designated as Distinguished Centers, 41 have graduated, and 17 are active during this reporting period.

The State Advisory Council for Science and Technology has advisory responsibility for the Centers of Excellence Program by statute. Members of the Science Council participate on the Centers Advisory Council in reviewing proposals and conducting site visits. This provides Science Council members with in-depth knowledge of the program, Center specific information and a strong technical and industrial perspective for making funding decisions. The State Science Advisor reviews the Annual Report and presents it to the Science Council for acceptance. The Director of the Office of Technology Development serves as an ex-officio member of the State Advisory Council for Science and Technology.

COMMERCIALIZATION PROCESS

Over the past four years, the Centers of Excellence Program has funded a consulting program to assist Center directors in preparing and implementing commercialization strategies. Each Center is unique in terms of which strategy is optimal - there is no single solution and each requires customized approaches.

Early market surveys and competitive analysis are conducted to discover which market segments are most promising and which product features will be of interest to potential customers and licensees. Consultants assist in targeting potential licensees for the technology and in positioning products for anticipated markets.

These early strategic discussions often reveal product variations that can be introduced to the marketplace earlier than previously planned. Such early commercialization has several benefits: (i) getting products to consumers for preliminary market validation and directional planning; (ii) early cash flow strengthens continuing research at the Center and hastens financial independence and; (iii) the future value of technology licenses are enhanced.

The Centers of Excellence Office works closely with the Technology Transfer Offices at the respective universities in an effort to extract maximum value from the licenses that are signed for Centers technologies. Through the commercialization consulting program assistance is given in defining market opportunities, identifying potential target licensees, providing key information for license valuations, and consulting assistance to those companies considering license opportunities.

II. Center Related Business Activity

1. This section introduces two new businesses recently incorporated and based on licensed technologies from funded Centers of Excellence. These young companies are representative of the types of high tech businesses which have developed from the Centers Program since its first funding in 1986. It is anticipated that as these companies mature they will have significant economic impact upon Utah's high technology business sector.

2. This section also summarizes invention disclosures, patents filed and issued and key license agreements signed as a result of Centers related activity. These measurements represent real and potential impact upon Utah's economy.

MINERAL TECHNOLOGIES, INC.

www.mineraltech.com.

Mineral Technologies, Inc. (MTI) is a spin-off company from the Center for Minerals Technology at the University of Utah. The company specializes in technology for the mineral, metallurgical and materials industries, through services, software products and consulting. Specific strengths of MTI arise from its ability to characterize materials quantitatively, accurately combined with a deep knowledge of particulate processing. These skills are critical when considering that the phenomena involved in particle processing are intimately associated to the particles physical/geometric properties.

Currently the company has three software products. First, MODSIM, the Modular Ore Dressing Simulator, a software with a wide range of applications in the mineral and coal industries, capable of simulating entire processing plants. Second, MMIA, a software for quantitative image analysis, which constitutes a complete package for image processing and measurement. Third, StereoSoft, MTI's advanced stereological correction software, which together with MMIA, makes quantitative information obtained from image analysis directly useful in routine industrial calculations. This type of information is also interfaced with MODSIM for industrial process characterization and simulation. Stereological correction, one of MTI's specialties, has a vast range of industrial applications, as for instance the measurement of grain/particle size distribution from images.

A remarkable application of this technology is OPSA, MTI's On-Line Particle Size Analyzer. This is a device developed to measure and detect changes in size distributions of particles or agglomerates on conveyor belts while being transported. OPSA has been used in crushing operations, quarry product control, SAG milling, pelletization and other applications.

Besides its line of products, MTI offers a variety of services, which include the measurement of particle fracture energy and stiffness, using the Utah Ultra-fast Load Cell, standard analytical procedures such as screening, Microtrac, BET, and Image Analysis (optical and scanning electron microscopy).

The company also specializes in liberation characterization services for the mineral industry. This includes liberation measurement on drill core sections, crushed particles and plant stream particles. Liberation data interpretation can include a complete evaluation of potential ore recovery and attainable grades, process design and optimization and even plant wide simulation.

ECHELON RESEARCH LABORATORIES INC.

www.echelon-inc.com

ERL is a new spin-off company from the Center for Cell Signaling at the University of Utah. Incorporated in October 1997 ERL develops high quality research reagents, used by scientists involved in cancer and inflammation research, and in other areas of medical and scientific research. ERL also develops high throughput assays to accelerate biochemical research in cancer and other disease processes, with the ultimate goal of utilizing these assays to search for molecules with therapeutic potential.

An estimated $60 - $100 million is spent annually for assays and materials used in the study of biochemical processes leading to the development of cancer and inflammation. Assays are used by researchers in academia and in the pharmaceutical industry to test for the presence of biological activity in certain systems and to evaluate the potential of certain molecules to block or enhance these processes. There is an evolving and continuing need for specialty chemicals used by scientists as research progresses. The nature of cancer research propels scientists to seek novel approaches and leading technology. Purchasing these novel products frees researchers from the time and cost of preparation, synthesis, validation and quality control.

To develop a specialty product line of high quality molecules, at the leading edge of technology, used by scientists involved in cancer research, principals of ERL identified a number of chemical products that are of great interest to the cancer research community through personal contacts and survey research. In particular, a number of products were identified because of their role in the process of cell communication or cell signaling particularly - phosphoinositide polyphosphates (PIPn) and isoprenoid diphosphates (IPP). The principals of the company have considerable expertise in the biochemical processes where these products play a critical role, and also expertise in the synthesis, purification and validation of these chemical products. A number of these products had already been produced at the University of Utah, and ERL was successful in licensing the rights to market these products. With this license and the expertise of ERL principals over 40 products were prepared for commercial sale. While these products are not patented, the barrier to competitive entry is the difficulty and sophistication required for complete synthesis. ERL produced its first product catalog and web site, and began offering these products for sale in April 1998.

No other company offers a complete set of phosphoinositide polyphosphates (PIPn) and isoprenoid diphosphates (IPP). Several companies offer a limited range of these molecules, but only ERL provides molecules that are fully synthesized (and not just purified from animal sources). ERL completed a survey of a sample of research scientists, which documented their

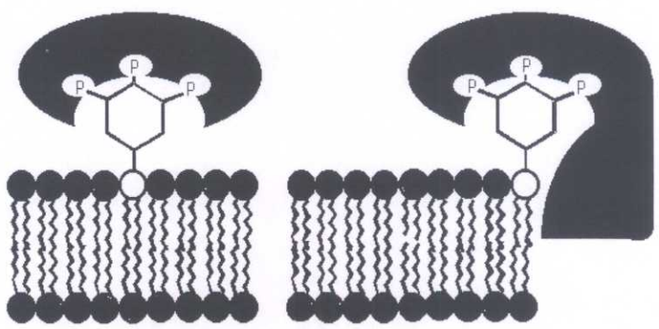
interest in the product line being assembled by ERL and to provide input into product selection and packaging.

The company is developing assays that will facilitate and accelerate biochemical research in cancer processes. Because of the intense scientific interest in cell signaling and its role in cancer development, ERL filed small business technology transfer grant applications (Phase I STTR grant) with the National Institutes of Health (NIH) focusing on a particular group of products - phosphoinositide polyphosphates (PIPn) and isoprenoid diphosphates (IPP). The NIH awarded two phase I grants totaling nearly $200,000. ERL is now in the process of preparing the Phase II grant application that will provide, if awarded, an additional $1,000,000 in start up and research funding. ERL also completed and filed three additional Phase I STTR grant applications and received favorable response from the NIH, indicating that at least one, and perhaps all three, of these grants will be awarded.

These grants provide the funding to develop standardized assays that allow researchers to detect the presence of selected processes in biological systems. ERL will develop two types of assays for high-throughput screening in early cancer detection and for determining the potential of the specific cancer cells to metastasize. Each assay will be produced in kit form, and will employ reagents uniquely produced by ERL. The company projects that during 1999 these assays will be completed sufficiently to begin pilot manufacturing.

Another major goal is to utilize ERL developed assays to search for molecules with therapeutic potential. Achieving this goal depends on the successful completion of assays and their acceptance in the scientific community. Principals of ERL are well qualified in scientific research in the processes of cell signaling and signal transduction in cancer cells. With low cost access to signal assays provided by in-house manufacturing, ERL expects to screen a number of molecules for biological activity, and then patent and license these molecules.

Signaling Molecules Probing Modes of Binding



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INTELLECTUAL PROPERTY STATUS AND LICENSE AGREEMENTS

Key indicators of the level of intellectual creativity at Utah Centers of Excellence include the submission of invention disclosures, patents issued and license agreements signed. As scientific discoveries are made, Centers researchers are encouraged to file invention disclosures, with the Technology Transfer office at the respective university. Disclosures are reviewed for scientific and commercial merit and the most worthy are then selected for patent preparation and filing. This expanding portfolio of intellectual properties represents a major asset for the centers program, since each disclosure and patent holds the potential for future commercialization. A brief description of each invention disclosure is included in **Appendix E**

Center	Invention Disclosures	Patents Filed or Issued (#)
Bioremediation	2	-
Cell Signaling	2	-
Industrial Imaging	2	-
Electronic Systems Technology	18	6
Scientific Computing and Imaging	1	-
Minerals Technology	7	-
Neural Interfaces	6	#5,215,088; #5,361760
Harsh Environment	11	3
Solid Oxide Fuel Cell Technology	5	-
Asynchronous Circuit Design	1	-
Raman Technology	1	-
Genome Technologies	5	-
Developmental Molecular Biology	2	1
Self Organizing Intelligent Systems	12	4

Two technologies including color quantization and intelligent scissors developed at the **Center for Intelligent Computer Tools** were licensed to **Adobe Systems Inc.**, San Jose, California.

One technology in the area of noise suppression, developed at the **Center for Signal Processing**, a previously funded Center, was licensed to **Sonic Innovations**, Midvale, Utah.

Technologies developed at the **Center for Self Organizing Intelligent Systems** were licensed to: **Campbell Scientific Inc.**, Logan, Utah (intelligent irrigation controllers); **Proform Fitness Products** Inc., Logan Utah (fuzzy-belt controller and fuzzy spotter); **Visionary Products Inc.**, Logan, Utah (red rover planetary exploration education project) and **Harvest Master Inc.**, Logan, Utah (improved potato harvester yield monitor) and **Design Analysis Associates Inc.**, Logan Utah (low cost secondary water meter).

Software developed at the **Center for Genome Technologies** was licensed to **Cimmaron Software Inc.**, Salt Lake City, Utah.

The technology related to the expression of foreign peptides in transgenic animals, developed at the **Center for Developmental and Molecular Biology** was licensed to **Pangenics**, Logan Utah.

A consortium agreement was signed between the **Center for Solid Oxide Fuel Cell Technology** and **Electric Power Research Institute, Gas Research Institute.**

III. Funded Centers

The following section is a listing of each Center funded during the 1997-1998 fiscal year - including Center background, technology information, accomplishments and contacts.

CENTER FOR APPLIED MOLECULAR GENETICS

CENTER

The Center for Applied Molecular Genetics (CAMG) was established in 1995 to identify specific DNA probes related to economically important qualitative and quantitative genetic traits in domesticated animals, e.g., cattle and pigs. DNA markers for traits such as back-fat thickness, feed conversion efficiency, and growth rate are of interest for swine, whereas in dairy cattle markers for annual milk and protein yield traits are being researched.

TECHNOLOGY

Useful DNA based probes are being evaluated. The technologies being developed for selecting DNA markers include: random amplified polymorphic DNA (RAPD), restriction fragment length polymorphisms (RFLP) and sequence characterized amplified regions (SCAR). The objective is to identify probes that correlate with useful qualitative and or quantitative traits.

Swine markers showing correlations with specific traits are: back-fat (9), feed intake (4), and growth rate (11). The search for DNA markers in dairy cattle to correlate with milk and protein yield, has resulted in the identification of 3 useful markers.

ACCOMPLISHMENTS

The economic value of the DNA markers and the methods for detecting them lies in the ability to identify desirable breeding animals before they mature and produce offspring thus reducing breeding costs significantly. Contacts with key swine and cattle breeding companies are being pursued and there are early indications of significant interest when the technology has been validated. Four markers for pig growth rates indicate a reduction of 15 days to market, which could be a significant economic benefit to the swine industry. Commercialization opportunities in other areas are also under investigation. DNA markers have been established for a serious disease called round heart (spontaneous cardiomyopathy) in turkey, which could be used for the benefit of Utah's turkey industry.

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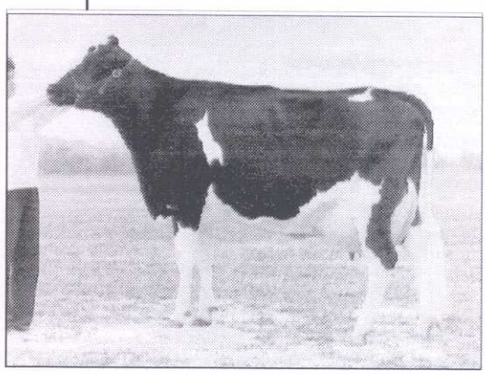
Can You Imagine...

... a library of genetic markers which would allow breeders to select sire animals that exhibit desired and valuable physical traits before actual breeding takes place?

THE CENTER INVESTIGATES GENETIC MARKERS ASSOCIATED WITH DESIRABLE TRAITS IN SWINE AND CATTLE AND PROPOSES TO MARKET ANIMAL SCREENING CAPABILITIES.



- SONATA , from the BYU Dairy breeding stock. This animal, which has a phenomenal record of high milk production, is typical of animals being evaluated for important genetic markers.

CENTER FOR ASYNCHRONOUS CIRCUIT AND SYSTEM DESIGN

CENTER

The Center was established in 1997 to complete the development of software design tools which will allow engineers to efficiently design digital circuits that do not require global clocking circuits in order to operate.

TECHNOLOGY

While most of today's digital systems use a synchronous global clock to coordinate operations within an integrated circuit, the challenge of distributing such global clock signals becomes increasingly difficult as circuit densities increase. Asynchronous circuits do not require a global clock and therefore do not require clock distribution lines as traditional synchronous circuits do. Industry has not moved to asynchronous design in large part owing to a lack of computer aided design (CAD) tools supporting this technology. Meeting this need is the direct target of this Center. It is working with companies such as Intel and IBM not only to help solve their future asynchronous design problems, but also their current difficulties in the analysis and verification of high-speed integrated circuits.

ACCOMPLISHMENTS

The Center has completed the compiler and timing analyzer portion of the CAD tool and expects to complete an alpha version of the tool this year. Patent applications are being prepared for submission in 1998. Intel Corporation and Cogency Technology are currently evaluating prototypes of the tool. The tool has also recently been used at IBM to analyze and verify the aggressive high-speed circuits used in their Gigahertz research microprocessor.

CONTACT

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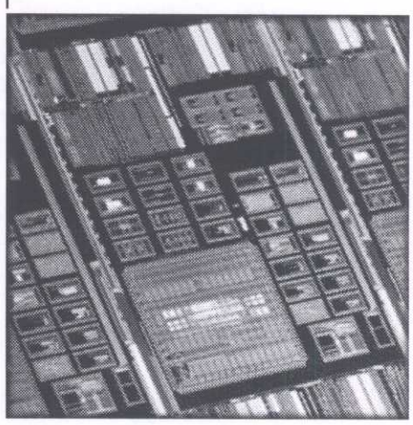
Can You Imagine...

. . . a personal computer that runs significantly faster than today's models because it does not depend on an internal clock to synchronize its various operations?

THE CENTER DEVELOPS DESIGN TOOLS FOR DIGITAL ENGINEERS CREATING NEW MICROPROCESSORS



■ Photo of the IBM Gigahertz research microprocessor as seen through a microscope. Up to 30% of the surface area of a high speed microprocessor chip may be required to distribute clocking signals.

CENTER FOR BIOREMEDIATION

CENTER

The Center for Bioremediation was established in 1996, to facilitate development, enhancement, and marketing of technologies based on microorganisms, biological materials, and cellular protein and enzyme components for bioremediation and environmental restoration applications. Microorganisms can be thought of as chemical factories, which in the process of growing and reproducing, metabolize and transform organics and inorganics (arsenic, nitrates, etc.) for energy and respiration. In this process metals can be transformed to more stable, less soluble, and/or less toxic states. The Center for Bioremediation develops, implements, and markets innovative biotechnologies to solve one of the most complex and widespread remediation problems - metals contamination.

TECHNOLOGY

The Center focus is on the commercialization of various aspects of microbial bioremediation technologies including, selenium removal/recovery, arsenic removal/recovery and cyanide destruction. Commercial applications of microbes, biopolymers/enzymes and bioprocesses are being explored. The Center is pursuing partnerships and collaborations with industry, federal agencies and universities in various areas of bioremediation.

ACCOMPLISHMENTS

A patent application for the selenium removal technology is in progress. This technology is scheduled for testing under the EPA Mine Waste Technology Program in Spring 1999. Pilot scale studies are planned with a Utah mining company and the Bureau of Reclamation. The Center has started collaborating with the Weber Basin Water District and the Bureau of Reclamation to develop proposals for water quality improvement. Under contract from the USDA Forrest Service, the Center is examining *Bacillus thuringiensis* (a bacterium with insecticidal properties) insecticides use on the Wasatch Front. Also under contract from NEDO the Center is examining the water quality in an innovative municipal waste treatment process.

CONTACT

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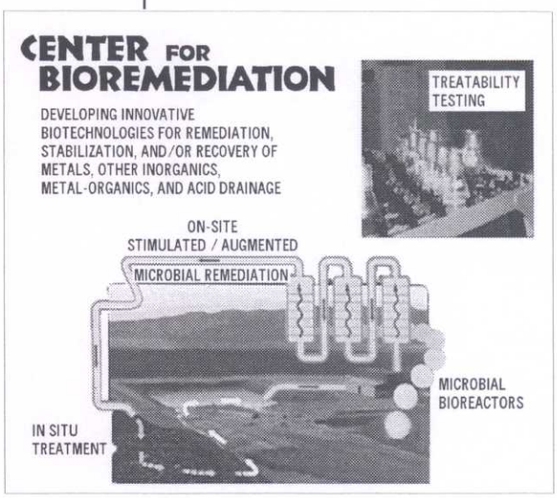
Can You Imagine...

. . . using enhanced microorganisms that will consume and neutralize hazardous heavy metals and other toxic materials in contaminated waste sites?

BIOREMEDIATION IS THE USE OF BIOLOGY AND TECHNOLOGY TO CLEAN UP ENVIRONMENTAL POLLUTANTS AND RECLAIM SOIL AND WATER SYSTEMS.



■ Block diagram of typical site remediation process.

CENTER FOR CELL SIGNALING

CENTER

The Center for Cell Signaling (CCS) was established in 1997. CCS aims to identify new therapeutic targets and new drug candidates for asthma, allergy, inflammation, and cancer. Each of these diseases arises because cells are communicating the wrong information, which can be fixed by disrupting incorrect messages and providing correct signals. With over $6 million in annual external support, 14 University of Utah faculty researchers from eight different departments on campus combine their talents in a synergistic way to create and commercialize new technologies.

TECHNOLOGY

The CCS technologies focus on the synthesis and drug applications of new molecules involved in cell-cell communication, from controlling the biochemical pathways of signal transduction to designing instruments used to study these processes. One recent development is the identification of a new tumor suppressor that is critical to cell adhesion, which when mutated leads to metastasis. Second, investigating the human genome with DNA micro-arrays has identified new drug targets. Third, development of automated high-throughput screening methods improves the rate of finding new drug candidates.

ACCOMPLISHMENTS

The CCS has filed 24 invention disclosures. **A new company has been spun-off, Echelon Research Laboratories.** The company markets reagents and kits for identifying oncogene activators and suppressors important in cancer diagnosis. Collaboration between CCS and Echelon Research Laboratories has resulted in two STTR awards from the National Institutes of Health. The figure on the right exemplifies the founding technology for Echelon Research Laboratories, the first CCS spin-off company.

CONTACT

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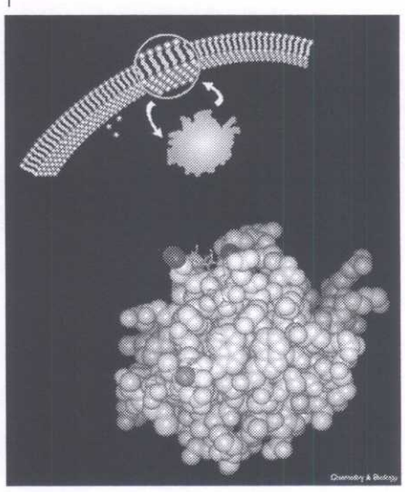
http://echelon-inc.com

Can You Imagine...

. . . a new class of pharmaceuticals that provide therapeutic effects by artificially signaling selected cells in the body to perform desired actions to the benefit of the patient?

THE CENTER DEVELOPS AND COMMERCIALIZES NEW TECHNOLOGIES FOCUSED ON THE TREATMENT OF CANCER, ALLERGY, ASTHMA AND INFLAMMATION.



■ Image was on the front cover of *Chemistry and Biology* and illustrates the recognition of a signaling lipid ($PtdInsP_2$) in a cell membrane by a protein (profilin) in the cytosol that controls the reorganization of the actin cytoskeleton during cell replication, growth, movement, and adhesion. It is from the paper A. Chaudhary, J. Chen, Q.-M. Gu, W. Witke, D.J. Kwiatkowski, and G.D. Prestwich, "Probing the Phosphoinositide 4,5-bisphosphate Binding Site of Human Profilin 1," *Chemistry and Biology*, Vol. 5, 273-281 (1998).

CENTER FOR COAL PROCESSING TECHNOLOGY

CENTER

The Center for Coal Processing Technology (CCPT) was established in 1996 to provide the advanced processing technology required to extract coal resins economically and promote the development of a coal resin industry in Utah.

TECHNOLOGY

CCPT has three proprietary technologies which will have applicability to Utah's coal industry: 1) processing technologies for the efficient retrieval and refining of organic resins from coal, 2) x-ray CT technology for the analysis of coal washability, and 3) methods for cleaning coal and development of the air-sparged hydrocyclone technology.

ACCOMPLISHMENTS

Significant meetings have been held with several companies who are expressing interest in the commercialization of Utah coal resin. These include Energy West, Plateau Mining Corporation, American Gilsonite, Andalex Resources, Skyline Coal, Coval Technologies, and White Oak Mining and Construction. Active cost reduction studies have been encouraging and could make the resin extraction process even more economically viable. CPT has engaged in active research regarding X-ray CT technology coal washability analysis in collaboration with Terra Tek, a Utah company. Results have been encouraging.

CONTACT

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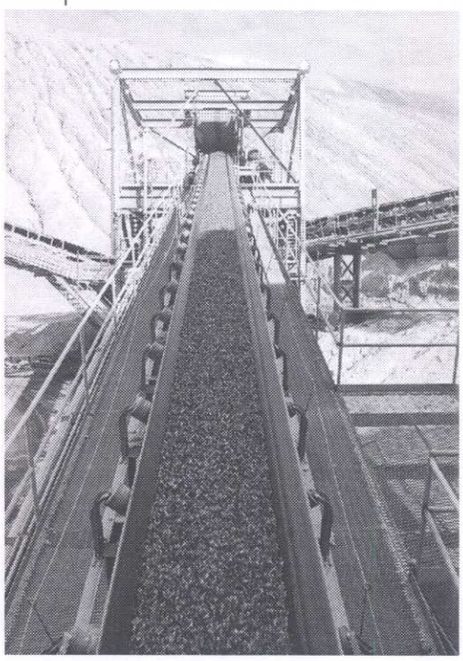
Can You Imagine...

. . . a profitable new industry that extracts valuable resins from Utah coal to be used in the manufacture of premium printers ink products?

THE CENTER PROMOTES THE DEVELOPMENT OF A COAL RESIN INDUSTRY IN CENTRAL UTAH AND PROVIDES AN ADVANCED PROCESSING TECHNOLOGY BASE FOR THE NATION'S COAL INDUSTRY.



■ Processed coal in state ready for washing and resin extraction.

CENTER FOR DEVELOPMENTAL AND MOLECULAR BIOLOGY

CENTER

The Center for Developmental and Molecular Biology (CDMB) was established in 1993. One of the Center objectives has been to investigate, characterize and synthesize several chemotherapeutic proteins, eg. lytic peptides and to develop cost-effective production methods. One of these methods involves the production of the proteins using genetically engineered animals (transgenic animals) that can secrete the proteins preferably at high concentrations in their milk.

TECHNOLOGY

Technologies are being developed for the high efficiency production of valuable proteins, not normally found in animal milk, by producing transgenic animals. A specific gene (DNA sequence) that codes for a specific protein is placed under the genetic control of a promoter that is expressed in mammary cells during lactation. The "genetically engineered DNA" is introduced into the embryo of selected animal species which, when successful, express the desired protein in the milk producing cells or glands. The expression of the foreign protein in the milk in relatively high quantities provides a cost-effective method of producing the valuable proteins.

ACCOMPLISHMENTS

Genes for specific proteins have been sequenced and prepared for injection into animal embryos. These genes have been successfully injected in mouse embryos and the transgenic nature of the new-born animals have been confirmed. Expression of a valuable protein has been confirmed in milk. Expression of the proteins in transgenic goats is highly desirable because the animals produce significant quantities of milk and are relatively easy to breed and maintain.

CONTACT

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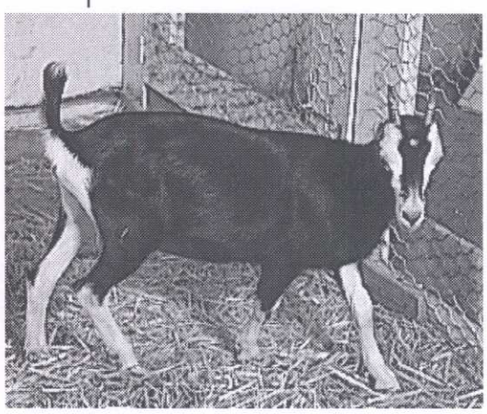
Can You Imagine...

. . . transgenic dairy animals used as manufacturing sites for the production of high value proteins in their milk.

THE CENTER INVESTIGATES SPECIFIC PROTEIN MOLECULES THAT MAY HAVE THERAPEUTIC VALUE AND THE PRODUCTION OF THESE PROTEINS IN THE MAMMARY GLANDS OF GENETICALLY ENGINEERED ANIMALS.



■ A transgenic goat produced at the Center has been evaluated for the expression of certain valuable proteins in her milk.

CENTER FOR ELECTRONIC SYSTEMS AND TECHNOLOGY

CENTER

The Center for Electronic Systems and Technology (CEST), established in 1995, combines the expertise, resources, and capability of three universities--the University of Utah, BYU, and Utah State University--to serve the industrial community in electronic systems technology. The goal of CEST is to ensure that Utah industry can compete more effectively in the global market and to enhance the opportunities for Utah researchers to develop and commercialize their technologies.

TECHNOLOGY

Electronic systems technologies include microelectronics, signal processing, communication and control systems, digital electronics, and RF, microwave, and millimeter wave electronics, as well as optoelectronics and electromagnetics. CEST provides research, design, evaluation, and prototyping services to Utah businesses that need specialized help in developing new products or enhancing market strengths. Services provided to industry include access to test equipment, laboratory testing, fundamental research and technology development, market analysis, personnel, information, and strategic planning.

ACCOMPLISHMENTS

Research contracts with a large number of technology based companies have been signed and are in progress. CEST also provides a stream of new commercializable technologies which are being patented and offered for licencing to Utah companies. New opportunities include high powered laser assemblies including a new 3-watt laser system, and new laser packaging technologies which could result in a new Utah laser manufacturing facility.

CONTACT

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Can You Imagine...

. . . a research and development Center (including experienced researchers, engineers, and world-class university facilities) funded to provide a stream of new electronic technologies and support to Utah companies?

THE CENTER PROVIDES RESEARCH, DESIGN, EVALUATION AND PROTOTYPING SERVICES TO UTAH BUSINESSES WHO NEED SPECIALIZED HELP IN DEVELOPING NEW PRODUCTS OR ENHANCING MARKET STRENGTHS.

■ CEST Advanced Electronic Test Laboratory

CENTER FOR UTAH GENOME TECHNOLOGIES

CENTER

Established as a Utah Center of Excellence in 1996, the Center's main focus is on developing and refining technologies for large scale sequencing and genotyping of DNA, the genetic material involved in inheritance of every organism. The Center is also developing technology for gridded DNA array detection.

TECHNOLOGY

The Center is developing novel technologies in three different areas: molecular reagents and techniques, automated sequencing devices, and computer software. Refinements to improve performance and reliability of the automated hybridization and imaging instruments are in progress. Independent testing of the instruments by non-center researchers is in progress.

ACCOMPLISHMENTS

Researchers at the University of Utah Human Genome Center have achieved international recognition in being part of the Human Genome Project, funded by the U.S. Department of Energy and the U.S. National Institutes of Health. The research group has been involved in a worldwide effort in sequencing the Human Genome. In addition, the Center continues to be at the leading edge of technology development for automated DNA sequencing. The Center will release the complete genome sequence of a microorganism of significant scientific and biotechnological importance. This sequence publication is among the first ten genomes completed world-wide and is an important milestone, showcasing the maturation of the Center technology.

The Center has licensed two software programs to a local company, Cimarron Software Inc.

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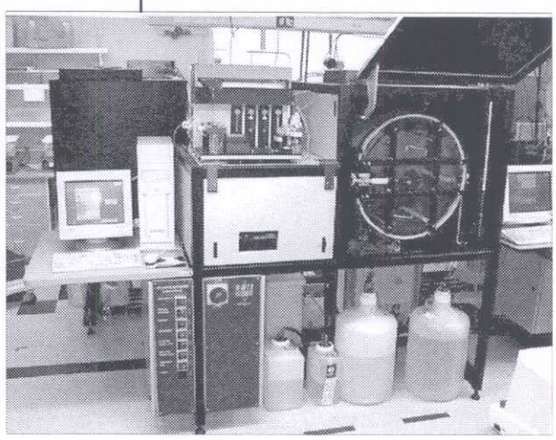
Can You Imagine...

. . . a method for greatly accelerating the analysis of genetic material to provide DNA sequence - a technology for rapidly sequencing of DNA and cataloging valuable genetic information.

THE CENTER, A PART OF THE INTERNATIONAL HUMAN GENOME PROJECT, DEVELOPS METHODS FOR RAPID, LARGE SCALE GENOME SEQUENCING, AND PROPOSES COMMERCIAL USES FOR THIS ANALYSIS.



■ Picture of the probe chamber, an instrument for multiplex sequencing designed and built at the genome Center.

CENTER FOR HARSH ENVIRONMENT ELECTRONICS

CENTER

The Center for Harsh Environmental Electronics (CHEE) (formerly the Center for Flat Panel Displays) was established in 1995 to develop micro-miniature thermionic vacuum emitter (MTV) display panels. As the MTV technology has matured and initial option to license agreements were signed, the Center has moved its focus to electronic circuits and devices for operation in high temperature operating environments.

TECHNOLOGY

Harsh Environment Electronics is focused on the development of harsh environment electronics systems such as gallium arsenide-based electronics that operate at high temperatures, MTV electronics, and electrical converters. CHEE also provides services in the following areas: prototype development and testing; development of high-temperature electronics based on MTV electronics technology; development of tools to test and evaluate flat panel display technologies; and work with industry (especially businesses located in Utah) in addressing and supporting their flat panel display technology needs. An enhanced flat panel display has been patented. A new company has been established with an option to license the flat panel display technology.

ACCOMPLISHMENTS

CHEE continues to develop strategic business partners for various implementations of the MTV technology. A strong intellectual property portfolio is being developed and will provide significant opportunities for corporate licensing of a wide variety of product implementations in the future. Currently one patent has been issued, one is pending and 15 additional patents are in preparation. A new company has been established with an option to license the flat panel display technology.

CONTACT

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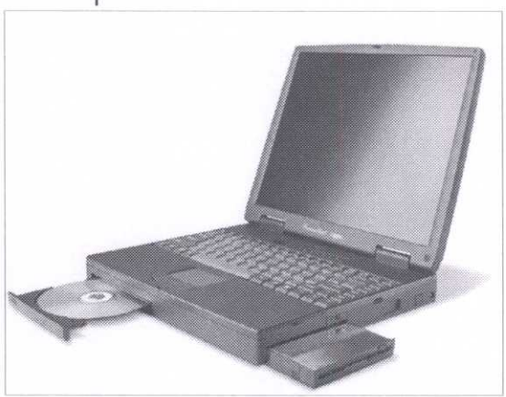
Can You Imagine...

. . . a new class of flat panel displays, brighter and with greater resolution than current displays, using micro-miniature vacuum tube emitters and manufactured much like silicon microprocessors?

THE CENTER EXPLORES ELECTRONIC CIRCUITRY THAT WILL OPERATE RELIABLY IN EXTREME HIGH TEMPERATURE ENVIRONMENTS.



- The demand for flat panel displays, in laptops like this one, and in many other applications, represents an immense commercial opportunity for the center.

CENTER FOR INDUSTRIAL IMAGING

CENTER

The Center for Industrial Imaging (CII) was established to commercialize image analysis, data analysis, and artificial intelligence technologies developed in the geosciences. Research at the University of Utah on fluid flow through porous media (i.e., aquifers, petroleum reservoirs) has resulted in generally useful image processing, image analysis, data analysis, and artificial intelligence techniques with commercial applications in geosciences and engineering.

TECHNOLOGY

CII technologies include Petrographic Image Analysis (PIA), which comprises four components: image acquisition, image processing, pattern recognition/data analysis, and linking to physical models. Each component involves specialized hardware, software, and expertise. The pattern recognition procedure within PIA has also proven useful in chemical fingerprinting in a variety of geoscience/environmental applications. CII has begun to explore areas outside geoscience applications, including the application of PIA to medical imaging, and especially to automated screening of prostate biopsies. CII also has been granted ownership of Integrated Paleontological System (IPS) software for further research, development, and commercialization. The Technical Alliance for Computational Stratigraphy (TACS), a consortium of eight petroleum companies, has been established to fund a three-year commercialization and development initiative.

ACCOMPLISHMENTS

The Technical Alliance for Computational Stratigraphy consortium of eight major petroleum companies, has been established to fund a three-year commercialization and development initiative to bring a commercial version of the PIA software to market. CII continues its partnership with the Energy and Geosciences Institute at the University of Utah to implement projects for the characterization of petroleum reservoirs and to demonstrate the utility of Center technology in commercial petroleum production settings. Collaboration continues with the University of Utah Department of Pathology to identify software modifications required to perform biological tissue analysis. The commercial goal is to market the licensed technology to medical pathology laboratories.

CONTACT

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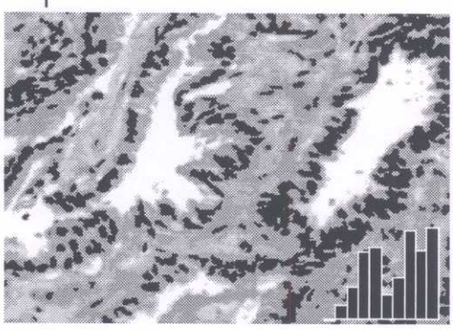
Can You Imagine...

. . . computational software that can automate the process of screening prostate biopsies and identifying suspected cancerous tissue using complex pattern recognition algorithms?

THE CENTER HAS DEVELOPED SOPHISTICATED SOFTWARE TO PROCESS DIGITAL IMAGES AND DO COMPLEX DATA ANALYSIS. COMMERCIAL APPLICATIONS INCLUDE BOTH GEOSCIENCE AND MEDICAL PRODUCTS.



■ Digitized image of prostate biopsy sample. Inset histogram represents dominant morphologic fingerprint present in this sample.

CENTER FOR INTELLIGENT COMPUTER TOOLS

CENTER

The Center for Intelligent Computer Tools (CICT) was first funded in 1996 to facilitate the creation of computer tools including interactive image segmentation and composition, automated creation of digital libraries, and semi-automated creation of virtual environments from real world images.

TECHNOLOGY

The technology development effort is concentrated in the following areas: 1) intelligent scissors/paint which performs image segmentation and composition, 2) color image resolution which magnifies full color images with little or no visual loss, 3) automated recognition and interactive internet browsing of digital documents, 4) virtual environments to create realistic virtual environments from real world images.

ACCOMPLISHMENTS

The Intelligent Scissors software, licensed to Adobe Systems Inc. was released in Adobe Photoshop 5.0 as a main feature and is being well received by users. A demonstration module of the Virtual Environment software, creating a digital mosaic of the Wasatch Front from Spanish Fork to Ogden, has been assembled and will be shown to the Salt Lake Olympic Organizing Committee. It is hoped that this software can be used to provide virtual images for Olympic media coverage.

CONTACT

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Can You Imagine...

. . . careening down an Olympic bobsled run, fully aware of the twisting turns and angles of the sled, while watching the surrounding landscape rush by, all on the screen of your computer with every visual sensation artificially created in software.

THE CENTER DEVELOPS INTELLIGENT COMPUTER TOOLS FOR THE CREATION, MANIPULATION, AND PRESENTATION OF DIGITAL IMAGES.

- The BYU Center involves four faculty and over twenty students in the development of Intelligent Interactive Tools for innovative imaging applications.

CENTER FOR MINERALS TECHNOLOGY

CENTER

The Center for Minerals Technology (CMT) was established in 1995. The focus is on developing new technologies for minerals processing. Specific areas of expertise include the design of high efficiency grinding mills using state of the art computer simulation software, advanced mill analysis and monitoring methods, technologies for the in-line monitoring and measurement of particle size on moving conveyor belts, and the real-time control of industrial milling processes.

TECHNOLOGY

Computer software, on-line instruments and laboratory procedures for the design, monitoring control and analysis of industrial grinding machines and operating plants have been demonstrated and are being designed for industrial applications.

ACCOMPLISHMENTS

An instrument to measure the distribution of sizes of particles on moving conveyor belts has been developed and successfully tested at industrial sites. This instrument is of great value because it eliminates the need to take samples from the conveyor for remote analysis and therefore provides real-time process control for mining and milling operations. A laboratory on-line particle analysis system (OPSA) was installed at an industrial site for plant control by pellet characterization. Two companies have taken licenses for the use of the OPSA technology. MillsoftTM, a grinding mill software, was sold to Process Engineering Resources, Inc., a Utah company. The program is made available for online access via the World Wide Web. Ten licenses were sold during the fiscal year to industrial customers, who have benefitted significantly in terms of improved productivity. MMIA - an image analysis software for mineral liberation analysis has been developed to commercial standards. Mineral Technologies Inc. will market this software. MODSIM - a modular simulator for ore dressing plants, consists of an extensive simulation system. A new modern user interface has been built for this software, which is compatible with the Windows operating system. The interface extends the applicability of this system to include large complex industrial plants. **A new start-up company Mineral Technologies Inc. has been spun-off from the Center**, specifically to market new technologies developed by the Center.

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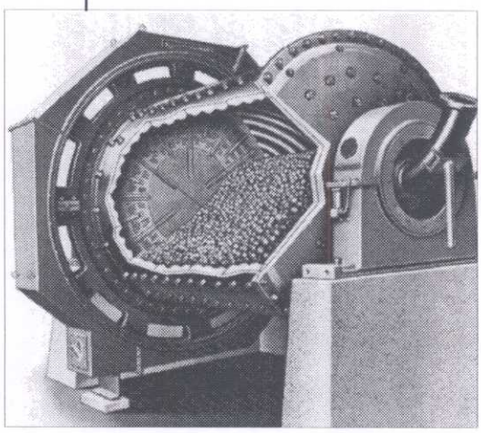
Can You Imagine...

. . . a tool which can observe milled materials traveling along a conveyor belt, calculate the average particle size and provide real time feedback to control and optimize the milling operation?

THE CENTER DEVELOPS LABORATORY AND COMPUTER SYSTEMS FOR OPTIMIZING PERFORMANCE AND MINIMIZING ENERGY CONSUMPTION IN INDUSTRIAL BALL MILLS WHICH ARE CENTRAL TO ALL MINERAL RECOVERY OPERATIONS.



- Typical ball mill grinding operation.

CENTER FOR NEURAL INTERFACES

CENTER

Established in 1995, the Center for Neural Interfaces (CNI) develops systems that enable research into the parallel processing of information by the nervous system. It is well-known that the individual neurons of the nervous system work in an integrated fashion to encode and process sensory information about the world around us, and to generate muscle command signals that enable us to interact effectively with this world. It is only by recording the activity patterns of large groups of neurons that we can begin to understand how sight, hearing, touch, and volitional information is encoded and processed by the brain. CNI is creating the tools that make these investigations possible.

TECHNOLOGY

CNI has invented silicon-bases with arrays of microelectrodes that can either listen in on or talk directly to hundreds of neurons simultaneously. This can now be done on a chronic basis in awake and freely behaving animals. CNI has developed surgical tools and techniques that allow these high-density microelectrode arrays to be implanted in central and/or peripheral nervous systems. It has also developed data acquisition systems that permit the large amounts of data recorded by these microelectrode arrays to be stored and analyzed in PC-class computers. It has written software that is used to acquire and analyze these neural signals. The long-range goal of the Center is to use these new neural interfaces as therapies for disorders of the nervous system. Ultimately, these systems may provide limited, but functional sensory restoration in individuals with profound blindness or deafness, and enhanced motor function to individuals with high spinal cord injuries.

ACCOMPLISHMENTS

Several prototypes from new inventions have been developed including a 100 channel neural signal amplifier together with a neural signal acquisition system and software. The development of a flexible micro-ribbon cable for a 12 pin skull connector was completed. A prototype of a high density array (100 um sensor distance) was completed.

Bionic Technologies, Inc., the Center spin-off company has undertaken the commercialization effort of the prototypes, developed at the Center, to the international research community. The company has already received two Phase I SBIR awards, a total of $200,000, and first year sales were estimated at over $100,000.

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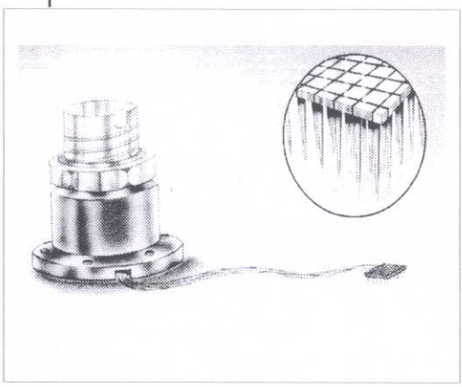
Can You Imagine...

. . . a miniature camera whose video output is fed to the visual cortex of a sight impaired person to provide artificial vision with sufficient resolution for key object identification?

THE CENTER WAS ESTABLISHED TO TRANSFORM THE NEUROPROSTHETIC TECHNOLOGIES DEVELOPED BY THE MORAN LABORATORIES FOR APPLIED VISUAL AND NEURAL SCIENCE INTO PROTOTYPE SYSTEMS FOR FUTURE CLINICAL APPLICATIONS.



- The array probe and connecting cable assembly.

CENTER FOR RAMAN TECHNOLOGY

CENTER

This Center was established in 1996 to commercialize Raman technology for chemical monitoring in natural gas, metal processing, and medical applications. Recent advances in instrumentation have made Raman scattering attractive as a general purpose analytical technique for measuring chemicals in solid, liquid and gaseous samples. Raman spectroscopy is the measurement of the wavelength and intensity of inelastically scattered light from molecules. The Raman scattered light occurs at wavelengths that are shifted from the incident light by the energies of molecular vibrations. Typical applications are in structure determination, multicomponent qualitative analysis, and quantitative analysis. The Center of Excellence for Raman Technology is a research Center committed to finding new applications for Raman Spectroscopy. We are currently developing External Cavity Laser Diodes for use with these Raman systems. The focus of the Center is to develop and test new designs and methods for using Raman Spectroscopy in a wide variety of settings. Currently work is being done on applications into different gas monitoring systems.

TECHNOLOGY

The technology development is focused in the following areas: laser diode configuration, sample handling schemes, fiber coupling techniques, data-analysis algorithms and modifications to the core Raman detection systems.

ACCOMPLISHMENTS

The Center has submitted nine invention disclosures in the following areas: glucose monitoring, frequently diversity, external cavity laser diode, mucosal cell, neural network analysis, liquid enhancement cell, egg reflector cell, fiberoptic coupling and holographic feedback element. The Center has developed effective collaborations with companies in steel, medical and energy industries, and has been successful in attracting several research and development contracts.

CONTACT

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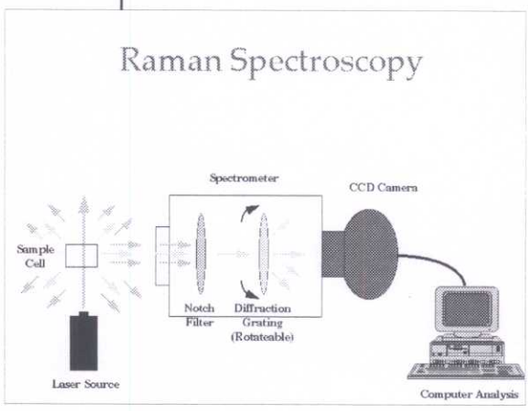
Can you Imagine...

. . . a sensor installed in the smokestack of a steel mill that provides real-time monitoring of stack gas constituents and controls the steel making process to minimize exhaust pollutants?

RAMAN SPECTROSCOPY IS A METHOD FOR ANALYZING THE CHEMICAL CONSTITUENTS OF SAMPLE MATERIAL BY DETECTING THE WAVE LENGTH OF LIGHT EMISSIONS GENERATED BY MOLECULAR VIBRATIONS IN THE SAMPLE.



- Block diagram of typical Raman Spectroscopy sampling system.

CENTER FOR SCIENTIFIC COMPUTING AND IMAGING

CENTER

The Center for Scientific Computing and Imaging (CSCI)was created in 1996 to make available a commercial version of the SCIRun Software System. This is an interactive, visually based, scientific, engineering, and medical programming environment that allows the interactive construction, manipulation, and visualization of scientific and engineering simulations.

TECHNOLOGY

SCIRun technology provides scientists and engineers with a new model for scientific computing. The model relies on modern computing technologies such as graphical user interfaces and 3D graphics to provide a visual programming and problem-solving environment to investigate complex problems. The increased flexibility attempts to provide a "computational workbench" for scientific computing where experiments are formed, new methods explored, and tedious coding kept to a minimum.

ACCOMPLISHMENTS

This past year, a new start-up software company was created from the CSCI's technology. The new company will reside in the University of Utah's Research Park. The Center has been approached by several interested in either licensing the SCIRun Software System and/or creating specific technology-oriented software packages based upon the SCIRun software. The Center also has been granted ownership of Integrated Paleontological System (IPS) software for further research, development, and commercialization. The Technical Alliance for Computational Stratigraphy (TACS), a consortium of nine petroleum companies, has been established to fund a three-year commercialization and development initiative.

CONTACT

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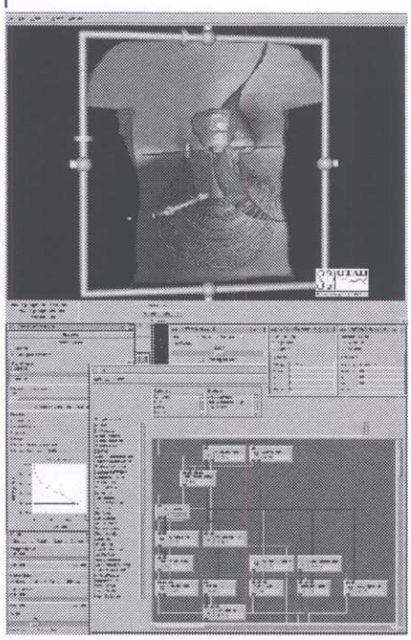
Can You Imagine. . . .

. . . software that can create detailed, three-dimensional images of human arterial systems from raw Magnetic Resonance Imaging (MRI) data and allow radiologists to rotate the images for complete diagnostic evaluation?

THE CENTER DEVELOPS SOPHISTICATED SOFTWARE THAT ALLOWS THE VISUALIZATION OF COMPLEX ENGINEERING AND SCIENTIFIC SIMULATIONS.



- Graphic shows an example SCIRun network, showing the dataflow programming interface, user interfaces for controlling simulation parameters, and results from a computer simulation of internal cardiac defibrillation.

CENTER FOR SELF ORGANIZING INTELLIGENT SYSTEMS

CENTER

The Center for Self-Organizing Intelligent Systems (CSOIS) was first funded in 1993 to build on its core intelligent systems technology to develop commercializable products to the economic advantage of the state. The Center provides design services to Utah companies to develop intelligent systems solutions for new and improved commercial products. The Center maintains a national and international reputation as a leading contributor to the advancement of intelligent systems research.

TECHNOLOGY

Intelligent systems technology has grown to include virtually any device and/or software concept which attempts to artificially emulate the unique cognizance and control abilities of the human mind. Artificial neural networks are designed to mimic the ability of the brain and central nervous system to learn and generalize from past experience. Fuzzy logic was introduced as a way of emulating the reasoning processes fundamental to human intelligence. Virtual presence controllers attempt to place the remote human operator or controller in a virtual environment identical to that encountered by the controlled process. Neural control emulates the sensory and communication mechanisms of the human neural system.

ACCOMPLISHMENTS

Two companies using CSOIS technology have been formed: **Visionary Products Inc. and Kachemak R&D Inc.** In addition, an existing company, **ME Labs**, a Japanese company, has located an office at the USU Research Park to capitalize on CSOIS technologies. Because of the success of its robotic intelligent vehicle mobility technology, **CSOIS was awarded a major Department of Defense research and development contract to apply that technology to lightweight military unmanned ground vehicles.** First year funding is in the amount of $2.5 M and with an additional $4 M expected in the second year. During the first year the project is expected to bring in around $1 M in salaries and benefits to the Cache valley region.

CONTACT

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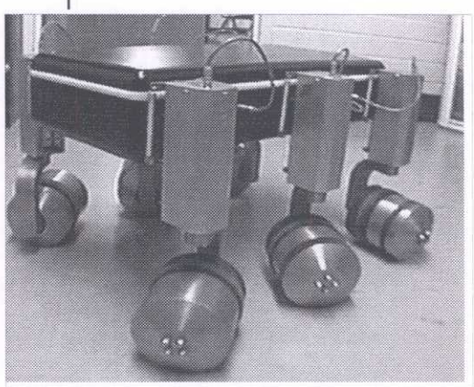
Can You Imagine...

. . . driving a remote mechanical rover across a Martian landscape, maneuvering around obstacles, retrieving soil samples, and pointing the rover camera in all directions to view the surrounding landscape, all from your personal computer.

THE CENTER INVESTIGATES ELECTRONIC AND SOFTWARE SYSTEMS THAT EMULATE THE LEARNING AND REASONING CAPABILITIES OF THE HUMAN MIND AND APPLIES THEM TO COMMERCIAL PRODUCTS.



- The newest rover, T1, which is the successor to the ARCIII

CENTER FOR SOLID OXIDE FUEL CELL TECHNOLOGY

CENTER

The Center for Solid Oxide Fuel Cell Technology (CSOFC) was established in 1996. The main focus of the Center is to develop solid oxide fuel cell (SOFC) technology for the direct conversion of chemical energy of a variety of fuels, such as natural or coal gas and other reformed logistic fuels, into electricity at a very high efficiency. Initially, the Center is developing cell stack technology for a 2 to 5 kilowatt unit, which has many potential applications with emphasis on distributed power for residential and remote locations for on-demand electrical power that is clean, efficient, reliable, and noise-free.

TECHNOLOGY

CSOFC technologies are based on the design and fabrication of novel, anode-supported solid oxide fuel cells with highly efficient electrodes that have a very low resistance. This concept makes it possible to develop a cost-effective, compact power unit for direct conversion of chemical energy of fuels into electricity for remote and residential applications.

ACCOMPLISHMENTS

A patent on the development of novel electrodes for SOFC was issued. Fuel cells that operate at lower temperatures but higher efficiency are being developed. Strategic business partners are being sought. Discussions are in progress with two Utah companies for the development and eventual commercialization of SOFC. The Center has been successful in attracting research and development grants from federal agencies as well as the Electric Power Research Institute (EPRI) and the Gas Research Institute (GRI). A low cost process for the fabrication of corrugated anode cell structure has been developed, which allows the stacking of 4 to 6 cells. Technology consortiums have been formed in partnership with EPRI and GRI. A strategic commercialization relationship with a local company Materials and Systems Research Inc. (MSRI) is under development.

CONTACT

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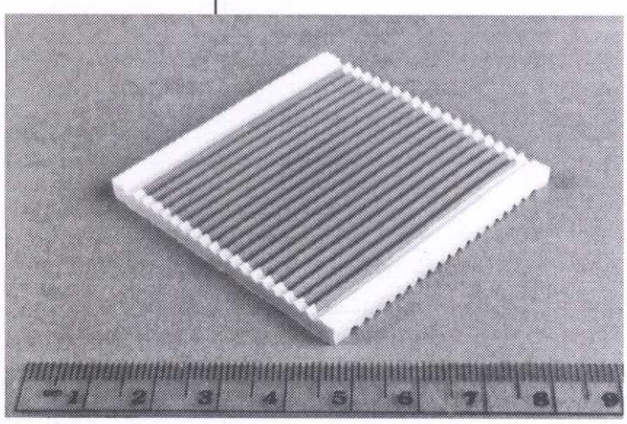
Can You Imagine...

. . . a portable generator you can take on your next camping trip that efficiently converts propane directly to electricity with no flame, no moving parts, no noise, and only carbon dioxide and water vapor as exhaust pollutants?

THE CENTER EXPLORES COMMERCIALLY VIABLE METHODS OF CONVERTING GASEOUS FUELS DIRECTLY INTO ELECTRICITY USING HIGHLY EFFICIENT FUEL CELL TECHNOLOGIES.



- Photo of a 5cm x 5cm solid oxide fuel cell (SOFC) made by the Center. The corrugations for the flow of fuel (e.g. natural gas) and oxidant (e.g.air) are in a cross-flow arrangement. The dark top surface is the cathode. SOFCs such as these are currently being configured into a stack. The objective is to construct a 2 to 5 kW stack for residential applications. The SOFC system will convert chemical energy of a variety of fuels into electricity.

IV. Appendices

A. Financial Summary

B. Economic Impact Summary

C. Fiscal Year 1998-1999 Funded Centers Summary

D. News Articles

E. Inventions Disclosed by Center

F. Legislation Creating the Centers of Excellence Program

Appendix A

CENTERS OF EXCELLENCE - 1997/1998 FINANCIAL SUMMARY

	State Funding 1997/1998	Cumulative State Funding	Fed. Match 1997/1998	Indust. Match 1997/1998	Total Match 1997/1998	Cumulative Total Match
CENTERS FUNDED IN FISCAL 1997/1998:						
Applied Molecular Genetics - BYU	$100,000	$315,000	$6,000	$1,146,000	$1,152,000	$2,180,740
Asynchronous Circuits - U/U	$100,000	$100,000	$2,750,000	$20,000	$2,770,000	$2,770,000
Bioremediation - WSU	$85,000	$175,000	$0	$14,745	$14,745	$1,678,945
Cell Signalling - U/U	$125,000	$125,000	$4,140,000	$634,500	$4,774,500	$4,774,500
Coal Processing Technology - U/U	$125,000	$225,000	$695,650	$375,421	$1,071,071	$1,389,404
Developmental Molecular Biology - USU	$100,000	$610,880	$175,000	$25,000	$200,000	$1,605,642
Electronic Systems Technology - U/U	$125,000	$435,000	$450,049	$50,000	$500,049	$2,061,724
Genome Technologies - U/U	$125,000	$300,000	$1,772,317	$0	$1,772,317	$7,288,574
Harsh Environment Electronics - U/U	$140,000	$330,000	$110,000	$585,000	$695,000	$1,417,655
Industrial Imaging - U/U	$110,000	$310,000	$0	$484,695	$484,695	$1,245,388
Intelligent Computer Tools - BYU	$95,000	$195,000	$0	$609,339	$609,339	$1,162,769
Minerals Technology - U/U	$115,000	$355,000	$0	$50,396	$50,396	$1,062,288
Neural Interfaces - U/U	$130,000	$310,000	$199,637	$69,438	$269,075	$2,651,701
Raman Technology - U/U	$95,000	$220,000	$139,791	$56,500	$196,291	$446,291
Scientific Computing & Imaging - U/U	$135,000	$270,000	$4,127,500	$0	$4,127,500	$4,453,314
Self-Organizing Intelligent Systems - USU	$100,000	$635,000	$847,000	$183,000	$1,030,000	$2,945,404
Solid Oxide Fuel Cells -U/U	$100,000	$200,000	$96,000	$295,000	$391,000	$721,397
Subtotals:	$1,905,000	$5,110,880	$15,508,944	$4,599,034	$20,107,978	$39,855,737
CENTERS NOT FUNDED IN FISCAL 1997/1998:						
All Graduated Centers		$17,728,775				$134,524,176
All Distingushed Centers		$5,890,440				$147,118,784
TOTALS:	**$1,905,000**	**$28,730,095**	**$15,508,944**	**$4,599,034**	**$20,107,978**	**$321,498,697**
1997/1998 MATCHING RATIO	**10.6 : 1**					
CUMULATIVE MATCHING RATIO	**11.2 : 1**					

Appendix B

CENTERS OF EXCELLENCE - 1997/1998 ECONOMIC IMPACT SUMMARY

CENTERS FUNDED IN FISCAL 1997/1998:	Center Jobs	Average Salary	Industry Jobs	Average Salary	Spin-Off Companies		Assisted Companies	Patents		Licenses
					New	Cum.		Pend.	Issued	
Applied Molecular Genetics - BYU	15	$27,847	n/a	n/a	0	0	7	0	0	0
Asynchronous Circuits - U/U	3	$57,733	n/a	n/a	0	0	0	0	0	0
Bioremediation - WSU	7	$23,429	2	n/a	0	1	19	0	0	0
Cell Signalling - U/U	19	$73,466	3	$36,666	1	1	1	2	0	1
Coal Processing Technology - U/U	3	$54,210	n/a	n/a	0	0	10	0	0	0
Developmental Molecular Biology - USU	13	$32,692	4	$29,670	0	1	10	2	1	1
Electronic Systems Technology - U/U	13	$39,231	3	n/a	0	2	27	4	1	1
Genome Technologies - U/U	34	$41,645	n/a	n/a	0	0	1	0	0	4
Harsh Environment Electronics - U/U	15	$23,414	16	$31,875	0	1	10	2	1	1
Industrial Imaging - U/U	8	$53,200	n/a	n/a	0	0	37	0	0	8
Intelligent Computer Tools - BYU	18	$27,973	n/a	n/a	0	0	4	0	0	2
Minerals Technology - U/U	8	$43,934	2	$50,000	1	1	2	0	0	1
Neural Interfaces - U/U	7	$31,429	10	$40,750	0	1	5	0	2	2
Raman Technology - U/U	3	$35,667	n/a	n/a	0	0	35	1	0	0
Scientific Computing & Imaging - U/U	7	$35,286	n/a	n/a	0	0	0	0	0	0
Self-Organizing Intelligent Systems - USU	19	$35,274	7	n/a	1	2	10	0	5	3
Solid Oxide Fuel Cells -U/U	9	$31,111	n/a	n/a	0	0	4	3	1	0
CENTERS NOT FUNDED IN FISCAL 1997/1998:										
All Graduated Centers	618	$29,936	488	$33,691		94	518		52	62
All Distingushed Centers	287	$29,176	524	$38,099		22	191		33	87
TOTALS:	**1106**	**$31,359**	**1059**	**$35,896**	**3**	**126**	**891**	**14**	**96**	**173**

Note: Information on industry jobs, average salary etc. is not available for Centers that have not as yet spun-off companies

1998-99 FUNDED CENTERS

Appendix C

The following Centers of Excellence have been funded during the fiscal year July 1, 1998 through June 30, 1999. They are listed to provide basic information on current funding as of October, 1998. The full report of Center activity for this fiscal year will be published in October, 1999.

CENTER	P.I.	Inst	Contact Numbers	Brief Description
Advanced Structural Composites	David Jensen	BYU	Tel (801)378-2094 Fax (801)378-4449 Email david@byu.edu	Develop the commercial products for the integration of damping materials with composites and the creation of light weight composite materials.
Asynchronous Circuit and System Design	Chris Myers Erik Brunvand	U/U	Tel (801) 581-6490 Fax (801) 581-5281 Email myers@ee.utah.edu Tel (801) 581-4345 Fax (801) 581-5843 Email elb@cs.utah.edu	Facilitates the systematic asynchronous and self-timed computer-assisted design tools into viable commercial products.
Biomolecular Technologies	Tore Straume	U/U	Tel (801)581-6853 Fax (801)581-7008 Email t.straume@m.cc.utah.edu	Commercialize new technologies for the separation of nucleic acid sequences with rearrangements and the positioning of biomolecules on surfaces.
Cell Signaling	Glenn Prestwich	U/U	Tel (801) 581-7063 Fax (801) 581-7087 Email gprestwich@deans.pharm.utah.edu	Focused on technologies important to the treatment of cancer, allergy, asthma, and inflammation. Near-term products for commercialization include chemical agents developed in the Center.
Composites in Construction	Chris Pantelides	U/U	Tel (801)585-3991 Fax (801)585-5477 Email chris@civil.utah.edu	Develop new products using advanced composites in construction. Focus is on rehabilitation of reinforced concrete structures with carbon fiber composites to improve service load strength and seismic capacity.
Electronic Systems Technology	R. Jennifer Hwu	U/U	Tel (801) 581-6954 Fax (801) 581-8541 Email hwu@ee.utah.edu	Works with industry to design and produce specific industrial-oriented electronic systems to enhance production and competitiveness. This enables industry to apply advanced university talent to industrial "real-life" problems.

CENTER	P.I.	Inst	Contact Numbers	Brief Description
Harsh Environment Electronics (Formerly MTV Flat Panel Displays)	Laurence Sadwick	U/U	Tel (801) 581-8282 Fax (801) 581-5281 Email sadwick@ee.utah.edu	Makes a low-cost, high yield microminiature thermionic vacuum emitters to perform the function of cathode ray tubes and matrix liquid crystal displays. Commercializing technologies related to high-speed digital and analog highpower and microwave electronics, microminiature thermionic converters, and flat-panel displays.
Industrial Imaging	Robert Ehrlich	U/U	Tel (801) 581-5906 Fax (801) 585-3540 Email behrlich@egi.utah.edu	Focused on the commercialization of a series of image analytical algorithms within a variety of industrial fields, particularly environmental assessment and medical imaging.
Intelligent Computer Tools	Bill Barrett	BYU	Tel (801) 378-7430 Fax (801) 378-7775 Email barrett@cs.byu.edu	Applies the use of intelligent computer tools for digital image composition, digital library creation, and creation of an interaction with virtual environments.
Minerals Technology	Peter King	U/U	Tel (801) 585-3113 Fax (801) 581-8119 Email rpking@mines.utah.edu	Developing technologies in comminution, or size reduction, used to extract minerals from mineral ores to produce aggregates for the construction industry, fine powders for manufacturing, and pulverized fuel for electric power generation.
Neural Interfaces	Richard Normann	U/U	Tel (801) 581-7645 Fax (801) 581-8966 Email normann@cc.utah.edu	Developing neuroprosthetic systems that will provide the restoration of limited sensation to the profoundly blind or deaf or to provide enhanced interaction of quadriplegics with their environment. A company has been formed to manufacture and distribute research tools.
Rapid Microbe Detection	Bart Weimer	USU	Tel (435)797-3356 Fax (435)797-2379 Email milkbugs@cc.usu.edu	Using immunoflow technology to detect contaminating microbes rapidly, to enhance real time decisions in several industries including food, pharmaceutical and public health.
Scientific Computing and Imaging	Christopher Johnson	U/U	Tel (801) 581-7705 Fax (801) 581-5843 Email crj@cs.utah.edu	Commercialization of the SCIRun Software System, a visually-based programming environment that allows the interactive construction, manipulation, and visualization of scientific and engineering simulations.

CENTER	P.I.	Inst	Contact Numbers	Brief Description
Self-Organizing Intelligent Systems	Robert Gunderson	USU	Tel (801) 797-2924 Fax (801) 797-3054 Email snowvax@cc.usu.edu	Helps Utah industry develop marketable products using the technology of self-organizing intelligent systems and to establish itself as a world leader in intelligent systems research.
Solid Oxide Fuel Cell	Anil Virkar	U/U	Tel (801) 581-5396 Fax (801) 581-4816 Email anil.virkar@m.cc.utah.edu	Researches electrochemical devices which can convert chemical-free energy of combustion of a fuel, such as natural gas or hydrogen, directly into electricity at very high efficiencies.
Western Dairy Foods Tech	Carl Brotherson	USU	Tel (435)797-3466 Fax (435)797-2379 Email wcdprt@cc.usu.edu	Commercialize technologies developed at the Western Dairy Center, USU, including cheese starter cultures, cheese flavor, cheese technology, and whey processing.

The Salt Lake Tribune
December 17, 1997

State Program Helps Create 7 Companies and Dozens of Jobs

BY LESLEY MITCHELL
THE SALT LAKE TRIBUNE

Utah's Centers of Excellence Program helped create seven new companies and more than three dozen new jobs during its budget year ending in June, according to a report issued this week.

The program, a part of Utah's Department of Community and Economic Development, aids in the commercialization of technologies developed at colleges and universities in Utah.

It funds individual R&D centers at the University of Utah, Brigham Young, and Utah State and Weber State universities from which new private companies emerge.

"We strongly feel we have a major impact on the number of high-tech jobs created in the state," said Rajiv Kulkarni, assistant director of the state's Office of Technology Development.

Since the program was created in 1986, it has helped create 123 companies and 1,050 jobs that pay an average of $35,000 a year, according to the report. The state has allocated $26.8 million to the program during that period.

Companies created through the program include Myriad Genetics Inc., a genetic testing and gene-discovery company, and Sarcos Inc., a designer and builder of robots. Both are located in Salt Lake City.

The new report is based on the last year the program operated on a $2.5 million budget. To help raise funds for Interstate 15 reconstruction, the 1997 Legislature reduced the Centers of Excellence Program's 1997-98 budget to $2 million.

Program officials said it is unlikely their budget will be restored at the $2.5 million level in the 1998-99 fiscal year, given the number of state programs vying for money and the state's obligations to continue funding the massive road project.

The reduced budget means 17 of the 21 centers funded in fiscal '96-'97 are receiving money.

"A lot of people think we are just funding research," Kulkarni said. "We provide funds to create new businesses."

Jack Adams, director of the Center for Bioremediation at Weber State University in Ogden, said legislators may not realize the program provides the state with tangible benefits.

"For the returns the Centers of Excellence make for the state, it's really a great investment," said Adams.

For every dollar of state funds the individual centers receive, they must then receive $2 from private and federal sources, he said. In the fiscal year ending in June, centers attracted much more than that: $20 million of outside funding, or $8.40 for each $1 in state funds it received.

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Deseret News
December 17, 1997

Excellent returns from job-creation program

In the fiscal year ending June 30, the state put $2.3 million into the Centers of Excellence program and received more than $20 million in matching funds, a ratio of 8.4 to one.

Even though the money allocated by the Legislature to the program dipped in the fiscal year from a regular $2.5 million, the program sparked the formation of seven new companies and more than three dozen jobs, according to the center's annual report.

The program was designed to transfer technology created or discovered on Utah's higher education campuses into companies and jobs. Since 1986, the state has put $26.8 million into the program, and matching funds from federal agencies and private industry have totaled $301 million, a ratio of 11.2 to one.

Rajiv Kulkarni, assistant director in the state's Office of Technology Development, believes this is the highest ratio for a program of this kind in the country.

The report that will be given to the Legislature said the new companies created in the fiscal year were Applied Biosciences Corp., Summit Park; PanGenics Inc., North Logan; Bonneville Technologies, Sandy; Livestock Molecular Research and Development Inc., Logan; Radiant Labs, Salt Lake City; Bionic Technologies Inc., Salt Lake City, and Visionary Products Inc., Richmond, Cache County.

D6
DESERET NEWS, WED. P.M./THUR. A.M., MARCH 25-26, 1998

ENTREPRENEURS

BYU imaging center does the impossible

By Roger Pusey
Deseret News staff writer

PROVO — Anyone who thinks they have seen just about everything done on computers should visit the state-sponsored center of excellence called Research of Interactive Visualization and Imaging Technology at Brigham Young University.

Center director William A. Barrett, professor of computer science and chairman of the Computer Science Department, and several people he brought into the center because of their varied expertise, is doing some unbelievable things with computers and digital imaging that has attracted interest from several high tech companies.

One of the programs the center people have developed is called "intelligent scissors." In a picture containing two people and only one image is desired for inclusion in a newsletter, for example, previously the person removing the image had to draw around the entire image.

Now, Barrett and his center workers have developed a software program that allows them to focus on one part of the image, and it is encircled and lifted off without the laborious tracing process.

One of Barrett's students presented a paper about "intelligent scissors" during the Special Interest Group in Graphics in Los Angeles in 1995. Some people from Adobe Inc. became interested and requested a showing of the technology in November 1995.

That was a prelude to the formation of the center of excellence, a program that grants money to various research programs on college and university campuses with the goal of spinning off companies and creating jobs.

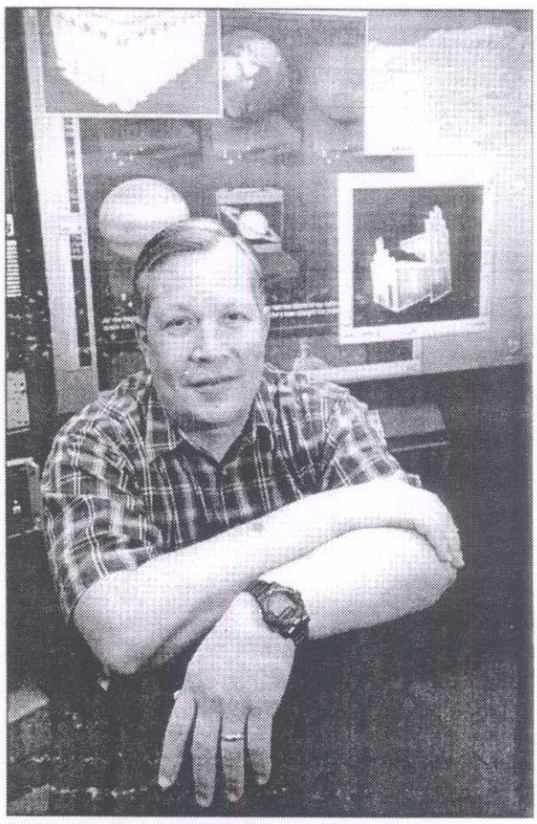
With a $100,000 grant from the state, Barrett started the center in July 1996, and in July 1997 the center received $95,000 from the state. For the fiscal year beginning July 1, 1998, the center has requested another $100,000.

"Had it not been for the state's support, the center would never have become a reality," Barrett said.

Based on the presentation to Adobe, the company provided some money for licensing of the "intelligent scissors" technology and a color quantization technology that provides colored digital pictures on a television screen that look as good as the original, but with one-third the memory.

Working with Barrett are Tom Sederberg, a professor of computer science well known for his work in computer graphics, and Bryan Morse and Parris Egberg, both assistant professors of computer science at BYU. Barrett said each brings his own expertise to the center.

Another project for the center was last summer's publication of thousands of personal histories for people connected with the sesquicentennial of the pioneers entering the Salt Lake Valley. Barrett said that by using information from a variety of sources, the center wrote a person's personal history in two minutes and also included pictures if any were available.



William Barrett heads BYU's Interaction and Visualization Center.

They have compiled a personal history for BYU President Merrill Bateman and will present it to him soon.

Another project Barrett is thinking about involves the Winter Olympic Games in Utah in 2002. If a visitor is curious about various games venues, they can get on the Internet, "fly" over Salt Lake City and the venues to determine the best way to get there.

The visitor also could "run" the various skiing courses while sitting in their office or home. All of this would be three dimensional so the mountains and valleys have height and depth.

The Salt Lake Tribune

THURSDAY, January 29, 1998

CLONING IN UTAH

Guess What? It Happens All the Time

Cutting Edge: Prof Works With Goats, Rare Sheep

BY LEE SIEGEL

Cattle, sheep and other livestock have been cloned routinely from embryo cells for years. But cutting-edge attempts to clone animals from adult cells — the process that produced Dolly the lamb in Scotland last year — are under way or planned at Utah State University.

Ken White — a USU professor of animal, dairy and veterinary sciences — hopes to produce clones of endangered Argali sheep from Tibet.

A few weeks ago, he took genes from adult Argali sheep cells frozen for years, placed them in eggs of domestic sheep, then grew the embryos in a culture. He implanted the embryos into four domestic sheep, but "we don't yet know if the animals are pregnant."

If White manages to clone the Argali sheep — a challenging task — they will be identical, lacking the genetic diversity that helps species adapt and survive. But in some species diversity already is gone, and cloning could prevent extinction, White said.

White also is trying to clone rabbits from adult rabbit cells in an effort to improve the method that produced Dolly. He also wants to try cloning cows from cells of an adult dairy cow that produced much milk. Lack of funding has stalled the project.

The USU researcher also is raising goats that carry a cloned plant gene. The gene should make the goats produce milk containing a protein used to enhance food flavors. The goats are not clones.

Gary Neuenswander/USU

Utah State University Professor Ken White is raising goats that carry a cloned plant gene.

The Salt Lake Tribune **UTAH** Saturday, August 15, 1998

U.'s new tool, the largest and fastest of its kind, features . . .

Eye-Catching Computer Power

BY LEE SIEGEL

THE SALT LAKE TRIBUNE

It is called the Onyx2 Reality Monster. It may improve treatment of epilepsy, deadly heart beats and ballooned-out blood vessels in the brain. It can help search for oil, design stronger buildings and analyze the most energetic particles in the universe. And it may upgrade Utah weather forecasting in time for the 2002 Winter Olympics.

The $4.5 million supercomputer, built by Silicon Graphics Inc. (SGI), was officially unveiled Friday at the University of Utah.

"At this point in time, it is the fastest and largest graphics-and-visualization supercomputer in the world," said Chris Johnson, a computer scientist who oversees the new SGI-Utah Visual Supercomputing Center.

"Soon we'll be overtaken by Los Alamos National Laboratory [in New Mexico], which is buying larger ones. But at this point, in terms of the graphics hardware, we have the fastest and the most of it in a single machine."

Silicon Graphics sold the machine to the U. for $2 million, less than half price, Johnson said. The company hopes its use in cutting-edge research will attract more customers, said sales representative Richard Grossen.

The Onyx2 contains 96 central processing units, or CPUs, each more powerful than a home computer: 64 to do computing, plus the equivalent of 32 CPUs in eight "visual pipelines" that generate graphics and display them at eight work stations. There also is an 8-by-10-foot computer screen.

Johnson said doctors recently used the screen to examine magnetic resonance images (MRIs) of a man in danger of sudden death from a brain aneurysm — a ballooned-out blood vessel that can rupture. MRIs were combined into a three-dimensional image that helped doctors plan the man's successful surgery.

U. computer scientist Chris Johnson stands in front of the new $4.5 million visual supercomputer.

The supercomputer is unique because it uses one computer program — developed at the U. — to combine computing, data-management and graphics chores once done by four or five programs in a time-consuming process.

The supercomputer and software allow scientists to change a simulation by adjusting graphics on the screen instead of punching new numbers into the computer. The revised simulation is shown immediately on the screen.

The device is being used to design better implantable defibrillators, which are surgically placed in the chest to shock the heart into a normal heartbeat if it starts deadly quivering. A designer sits at the computer screen displaying a graphic of the chest and heart, including electrical activity. The designer can adjust the number, size, shape and placement of defibrillator electrodes and how much voltage they deliver. The supercomputer then simulates and displays how the defibrillator would affect the heart's electrical activity.

Meteorology professor John Horel is using Onyx2 to simulate how mountains affect weather, with the aim of improving forecasts during the Olympics.

U. researchers also are simulating epileptic seizures so surgeons can pinpoint and remove malfunctioning brain tissue. Mysterious high-energy cosmic rays, the most energetic particles known, also will be analyzed.

The machine can depict rock layers — including pockets with oil — and help design buildings to better resist strong winds and earthquake shaking.

Johnson said demand for the machine is climbing rapidly, and hundreds of U. researchers and students eventually will use it.

Appendix E

BRIEF DESCRIPTION OF INVENTIONS DISCLOSED BY CENTERS

Center of Excellence	Disclosure Number and Title	
Industrial Imaging	U-2358	Diagnosis of Pathology Slides Using Multivariate Morphologic Measurements and Self Training Classifier
	U-2643	Applications of PVA (SAWVEC) to Seismic Analysis
Electronic Systems Technology	U-2293	High Power Green Light Generation from Diode Lasers
	U-2294	High Power Blue Light Generation from Diode Lasers
	U-2375	Novel Beam Couplers/Correctors
	U-2400	Improved Laser Mode Control of Vertical Cavity Surface Emiting Lasers (VCSELs)
	U-2510	New Cavity design for Semiconductor Laser
	U-2512	New Ohmic Contact For Lasers
	U-2515	High-Power (mW Level) Blue Light Emission from Infrared Diode Laser Assembly
	U-2516	A Phosphorus Cell
	U-2518	Novel Configuration of Multiple Diode Laser Assemblies
	U-2519	Rare-Earth/III-V Binary Compounds as High Temperature-Contacts to III-B Compound Semiconductor
	U-2526	A Nonlinear Algorithm and FDTD Software for Modeling Series for Modeling Series Elements in one FDTD Cell
	U-2527	Novel Diode Laser Arrays Providing Higher Power Capability and Better Beam Quality
	U-2542	High-Power Diode Laser and Diode Laser Array Beam Corrector
	U-2574	Low Cost, Compact, High Power Diode Laser Systems
	U-2587	Diode Laser Cavity Design for Beam Quality Control
	U-2683	Development of Pumping Technologies for Very High Power Diode Pumped Solid-State Laser Systems
	U-2716	Novel Beam Shaper (Confiner) Design for lasers
	U-2725	Diffractive Optics for Astigmatism Correction
Scientific Computing and Imaging	U-2199	Computational Steering Software
Minerals Technology	U-2720	Development of In-Line De-Ashing of Pulverized Coal Using Triboelectrostatic Cleaning
	U-2735	ULFC-Ultra Fast Load Cell
	U-2745	Stereological Correction of Mineral Liberation Measured Data
	U-2746	Software for Construction of Andrews-Mika Diagrams
	U-2747	Software for Image Analysis of Mineralogical and Metallurgical Materials
	U-2748	Software for Ultrafast Load Cell (ULFC) Signal Acquisition and Analysis
	U-2749	In-line De-Ashing and Desulfurigation of Pulverized Coal Using Electostatic and Centrifugal Cleaning

Center of Excellence	Disclosure Number and Title	
Neural Interfaces	U-1319	Three-Dimensional Electrode Device
	U-1719	Method for Providing Large Temperature-Gradient in Silicon Wafers
	U-1811	Impact Inserter for Implantation of a Biomedical Device
	U-1813	3-D Signal Processing Architecture
	U-2022	High Density Micro-ribbon Cable for Multi-pin Contact Applications
	U-2520	UIEA in Dog Olfactory Bulb
Cell Signaling	U-2657	Discovery of Peptides that Mimic Hyaluronic Acid
	U-2658	Discovery of Peptides that mimic Phophatidylinositol Polyphosphates
Harsh Environment Electronics	U-1721	Microminiature Thermionic Vacuum Tube
	U-1730	Anti-Symmetrical Series Schottky Backward Diode
	U-1834	High Temperature Circuit with Bias Voltage
	U-2030	Fabrication of microminiature Thermionic Vacuum Tube Devices (MTV)
	U-2041	Operation of Silicon on Insulator Electronics at Elevated Temperatures
	U-2422	A new Cracker Cell Design
	U-2480	Microminiature Thermionic Converters
	U-2512	Ohmic Contacts Formed by CuGe to n-Type Layers of GaAs-Based Lasers
	U-2516	A phosphorus Cell
	U-2519	Rare-Earth/III-V Binary Compounds as High Temperature Contacts to III-B Compound Semiconductor
	U-2682	MTV-Based Microwave and RF-Transmitters for Use in Movile Communications and High Power Applications
Solid Oxide Fuel Cell Technology	U-2539	Planar Solid Oxide Fuel Cell (SOFC) Stack with a Metallic Foil Interconnect
	U-2598	High Power Density Solid fuel Cells (SOFC) using Improved Anode and Cathode
	U-2606	Novel, Internally Manifolded, Electrode-Supported Solid Oxide Fuel Cell
	U-2619	La2NiO (4+d)-based and La2CuO (4+d)-based Cathode Materials for Solid Oxide Fuel Cells (SOFCs)
	U-2670	Mixed Oxygen Ion and Proton-Conducting Solid Electrolyte for Solid Oxide Fuel Cells (SOFCs)
Asynchronous Designs	U-2583	Center Version of ATACS
Raman Technology	U-2679	Visual Representation Design of Integrated Physiologic Data in Real Time

LEGISLATION
CREATING THE CENTERS OF EXCELLENCE

PART 6
CENTERS OF EXCELLENCE

9-2-601.Purpose.

(1) The Legislature recognizes that the growth of new industry and expansion of existing industry requires a strong technology base, new ideas, concepts, innovations, and prototypes. These generally come from strong research colleges and universities. Technical research in Utah's colleges and universities should be enhanced and expanded, particularly in those areas targeted by the state for economic development. Most states are enhancing their research base by direct funding, usually on a matching basis. The purpose of this part is to catalyze and enhance the growth of these technologies by encouraging interdisciplinary research activities in targeted areas. The Legislature recognizes that one source of funding is in matching state funds with federal funds and industrial support to provide the needed new technologies.

(2) The Legislature recommends that the governor consider the allocation of economic development funds for Centers of Excellence to be matched by industry and federal grants on at least a two-for-one basis.

(3) The Legislature recommends that such funds be allocated on a competitive basis to the various colleges and universities in the state. The funds made available should be used to support interdisciplinary research in specialized Centers of Excellence in technologies that are considered to have potential for economic development in this state.

History: C.1953,63-62-1, enacted by L. 1985, ch. 103, 1; 1986, ch. 109, 1; renumbered by L. 1992, ch. 241,60.

Amendment Notes. - The 1992 amendment, effective March 13, 1992, renumbered this section, which formerly appeared at 63-62-1, and substituted "part" for "chapter" in Subsection (1).

9-2-602. Short title - Definitions.

(1) This part is known as the Centers of Excellence Act."

(2) As used in this part, "Centers of Excellence" means university-based, industry-supported, cooperative research and development programs.

History: C. 1953, 63-62-2, enacted by L. 1985, ch. 103, 2; 1986, ch. 109, 2; renumbered by L. 1992, ch. 241, 61.

Amendment Notes. - The 1992 amendment, effective March 13, 1992, renumbered this section, which formerly appeared as 63-62-2, inserted the subsection designations; and substituted "part" for "chapter" in two places.

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